|  |  |  |
| --- | --- | --- |
| **Characteristic** | **Trend (left to right)** | **Reason** |
| Atomic radius | decreases in size from left to right | increased attractive force (acting on the same energy shell) from the nucleus as the number of protons (and hence the nuclear charge) increases |
| Ionic radius | decreases across the period until formation of the negative ions then there is a sudden increase followed by a steady decrease to the end | In general as above. The sudden increase on formation of negative ions is due to the new (larger) outer shell |
| Electronegativity | Increases | More electron attracting power of the larger nuclear charge as we move to the right |
| Metallic character | Decreases - Na, Mg, Al metals; Si metalloid; P, S, Cl, Ar non-metals | Metallic character is a measure of the ease of loss of electrons from the outer shell. This decreases with increasing nuclear charge. |
| Oxides | Na, Mg - alkaline Al - amphoteric Si, P, S, Cl -acidic |  |
| Chloride character | NaCl - ionic MgCl2 - some covalent character AlCl3 - covalent The remainder covalent | Increasing charge density of the positive ion polarises the chloride ion as we move to the right hand side |
| Melting point | |  |  | | --- | --- | | Na**http://ibchem.com/root_img/reaction_arrow.GIF**Al steady increase | Increasing availability of electrons in the metallic bonding associated with greater charge density of the metal ion | | Si massive increase | Si giant macromolecular structure | | P large decrease | P4 molecules | | S small increase | S8 molecules | | Cl **http://ibchem.com/root_img/reaction_arrow.GIF**Ar decrease | Cl2 molecules and Ar atoms | | |

**T03D03 – Periodicity of Period 3 Oxides and Chlorides**

**Chemical periodicity of period 3 oxides**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Na2O | MgO | Al2O3 | SiO2 | P4O10  (or P4O6) | SO3  (or SO2) | Cl2O7  Cl2O |
| Add H2O | Na2O + H2O -> 2NaOH | MgO + H2O -> Mg(OH)2 | Insoluble | Insoluble | P4O10 + 6H2O -> 4H3PO4  P4O6+ 6H2O -> 4H3PO3 | SO3 + H2O -> H2SO4  SO2 + H2O -> H2SO3 | Cl2O7 + H2O -> 2HClO4  Cl2O + H2O -> 2HOCl |
| Add HCl | Na2O + H+ -> 2Na+ + H2O | MgO + 2H+ -> Mg2+ + H2O | Al2O3 + 6H+ -> 2Al3+ + 3H2O | No reaction | No reaction | No reaction | No reaction |
| Add NaOH | No reaction | No reaction | Al2O3 + 2OH- + 3H2O -> 2Al(OH)4 | SiO2 + 2OH- -> SiO32- + H2O | H3PO4 + OH- -> H2PO4- + H2O  H3PO3 + OH- -> H2PO3- + H2O | SO2 + OH- -> HSO4-  SO2 + OH- -> HSO3- | HCl2O7 + OH- -> Cl2O72- + H2O  HOCl + OH- -> OCl- + H2O |
| Nature | Basic Oxide | Basic Oxide | Amphoteric Oxide | Acidic Oxide | Acidic Oxide | Acidic Oxide | Acidic Oxide |
| Conductivity | Good | Good | Good | None | None | None | None |
| Melting Point | 1275 | 2852 | 2027 | 1610 | 24 | 17 | -92 |

**Chemical periodicity of period 3 chlorides**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **NaCl** | **MgCl2** | **Al2Cl6** | **SiCl4** | **PCl3** | **PCl5** | **Cl2** |
| Add H2O | **Dissolves** to give free ions | **Dissolves** to give free ions | **Hydrolysis** to give [Al(H2O)6]3+ and Cl- ions | **Reacts** to produce HCl and Si(OH)4 | **Reacts** to produce H3PO3 and HCl | **Reacts** to produce H3PO4 and HCl | **Dissociates** to give HOCl and HCl |
| Nature | ionic | ionic | covalent | covalent | covalent | covalent | covalent |
| Conductivity | Good | Good | None | None | None | None | None |
| Melting Point | 801 | 714 | 178 | -70 | -112 |  | -101 |